

# **Biological Evaluation of Ash Trees along C&O Canal National Historical Park**



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### Cover Photo

Debbie Miller, USDA Forest Service, Bugwood.org

## **Abstract**

During the summer of 2014, Forest Health Protection personnel from the Forest Service, U.S. Department of Agriculture, Northeastern Area State and Private Forestry Field Office in Morgantown, WV, conducted a survey to detect emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae), at selected campgrounds and areas within the Chesapeake and Ohio Canal National Historical Park. The purpose of the survey was to see if EAB was present and determine the need for management activities along the C&O towpath to preserve ecological diversity and prevent hazard trees. Since EAB has been found and is actively impacting the ash resource, we recommend that C&O Canal NHP personnel develop a comprehensive ash management plan and that a chemical suppression/prevention treatment plan be put into place to protect high-value ash (*Fraxinus* spp.) trees. We also recommend the release of biological control agents.

## **Purpose and Need**

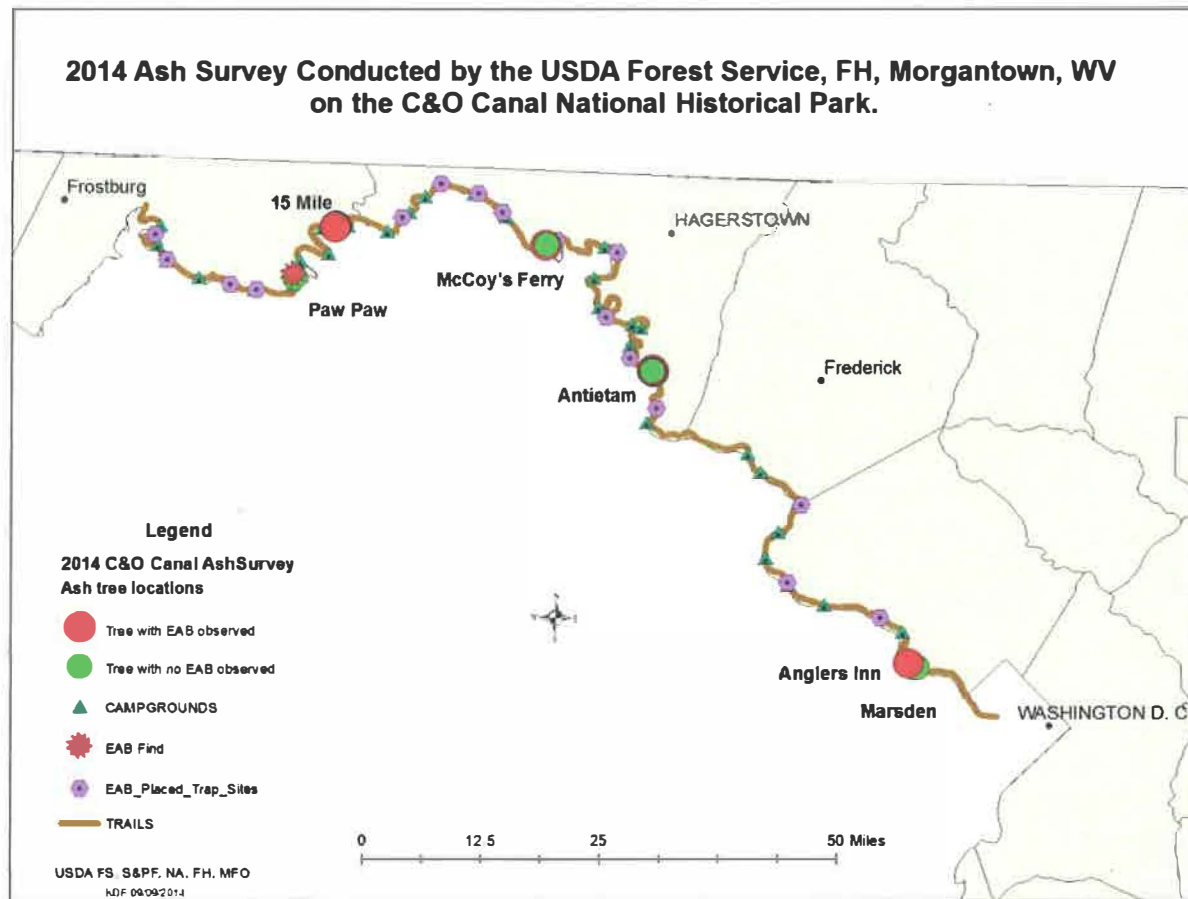
The Forest Health Protection unit of the Forest Service's Northeastern Area State and Private Forestry Field Office (MFO) in Morgantown, WV, received a request from Superintendent Kevin Brandt, with the National Park Service (NPS), C&O Canal NHP, who was concerned about declining ash along the trail creating potential hazard trees. The MFO addressed the request to investigate five C&O Canal NHP campgrounds (Marsden Tract, 15 Mile Creek, Paw Paw, McCoy's Ferry and Antietam Creek), Bear Island (for Pumpkin Ash only) and an overlook near Angler's Inn, for signs or symptoms of EAB and identify any significant issues that might occur as a result of borer activity within these campgrounds. The MFO also evaluated what management options are available to protect and maintain the ash resources and prevent hazard trees in the park.

## **Project Location Description**

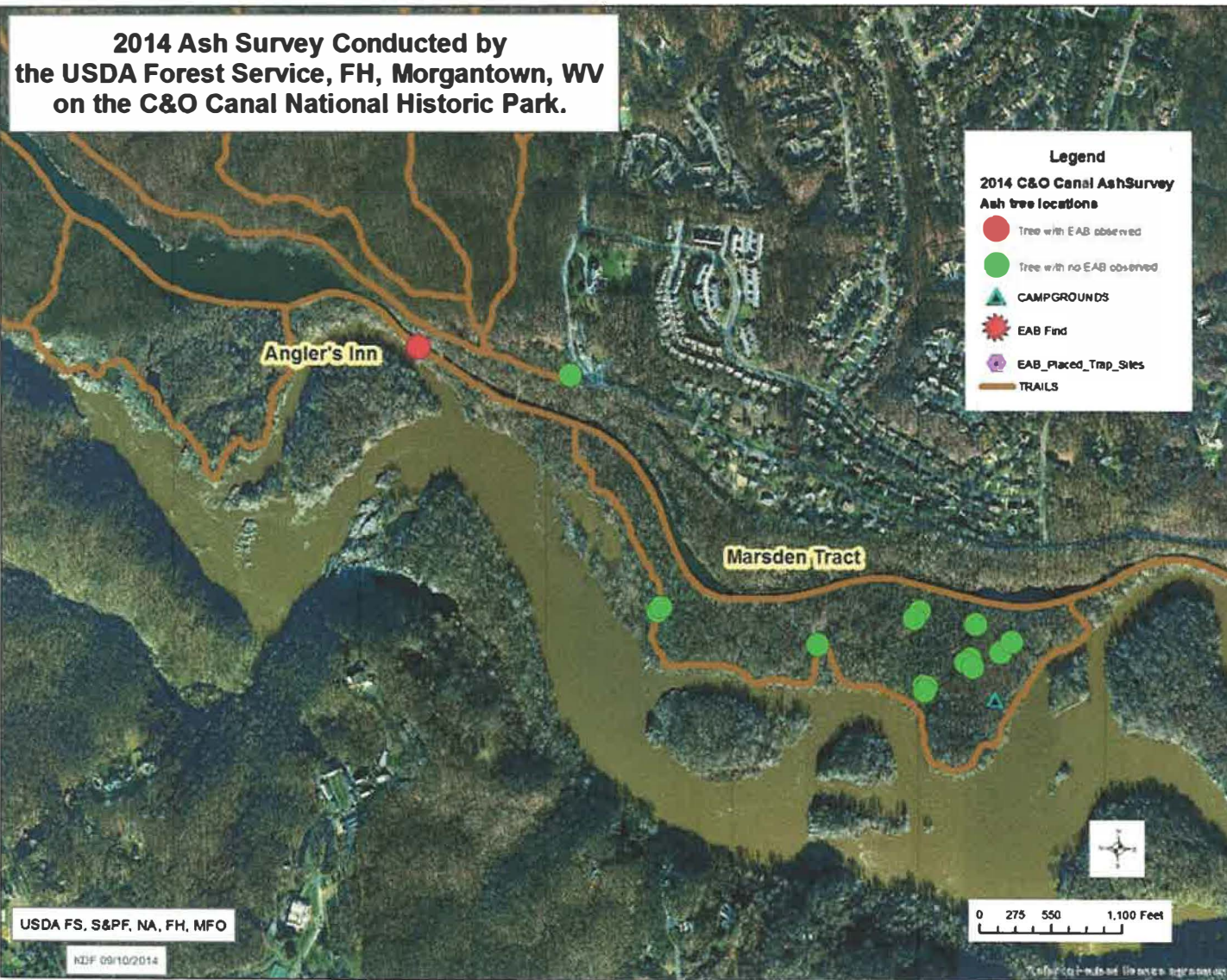
The Chesapeake and Ohio Canal National Historical Park runs along the Potomac River from the mouth of Rock Creek at Georgetown in Washington, DC, to Cumberland, MD for 184.5 miles, encompassing a fragmented 19,587 acres of predominantly riparian habitat. The canal's 74 lift locks raised canal boats from near sea level to 605 feet of elevation at Cumberland. The towpath, built 12 feet wide as a path for mules, is now a nearly level byway for hikers and bicyclists to enjoy the canal.

Eighty-five percent of the park lies in the 100-year floodplain of the Potomac River, and the park experiences major floods every 12 years on average. C&O Canal NHP is a biologically diverse park: More than 1,200 vascular plants, 192 birds, 64 fish, 62 reptiles and amphibians, and 47 species of mammals. Of these, nearly 200 are state or federally listed as rare, threatened or endangered. The park has documented more than 200 exotic plant species and 14 exotic animal species. The park has been in the Maryland EAB quarantine zone since 2012.

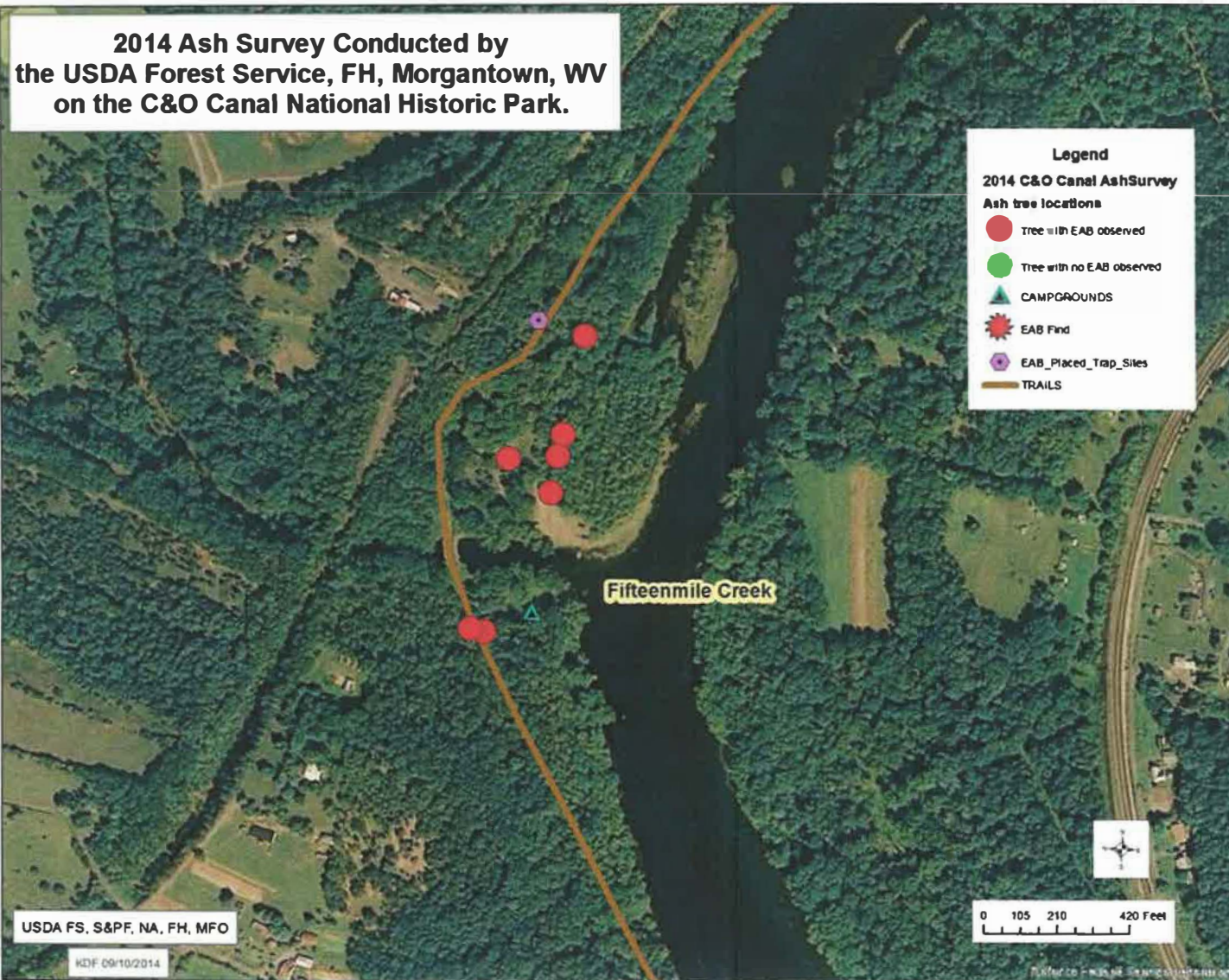
As the park runs along the Potomac River it passes through four major physiographic regions, Ridge and Valley, Blue Ridge, Piedmont, and Coastal Plain. The park also protects the largest extant block of upland forest in Maryland's Piedmont, known as the Goldmine Tract near Great Falls, and the highest quality limestone and calcareous shale habitats remaining in the state, Ferry Hill bluffs and Chilton Woods.



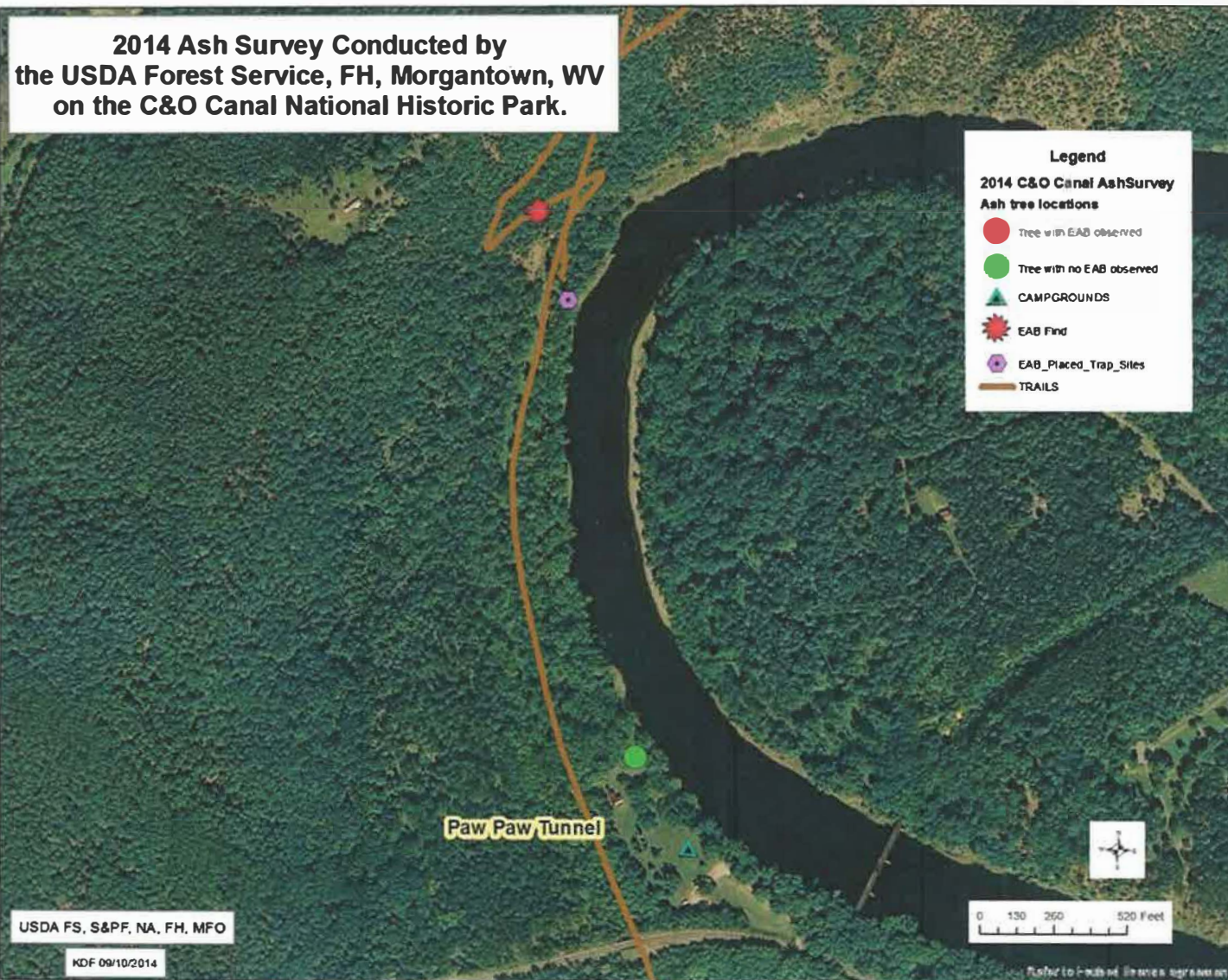
**Figure 1.** C&O Canal NHP with Campground and area locations.



**Figure 2.** Marsden Tract Campground.



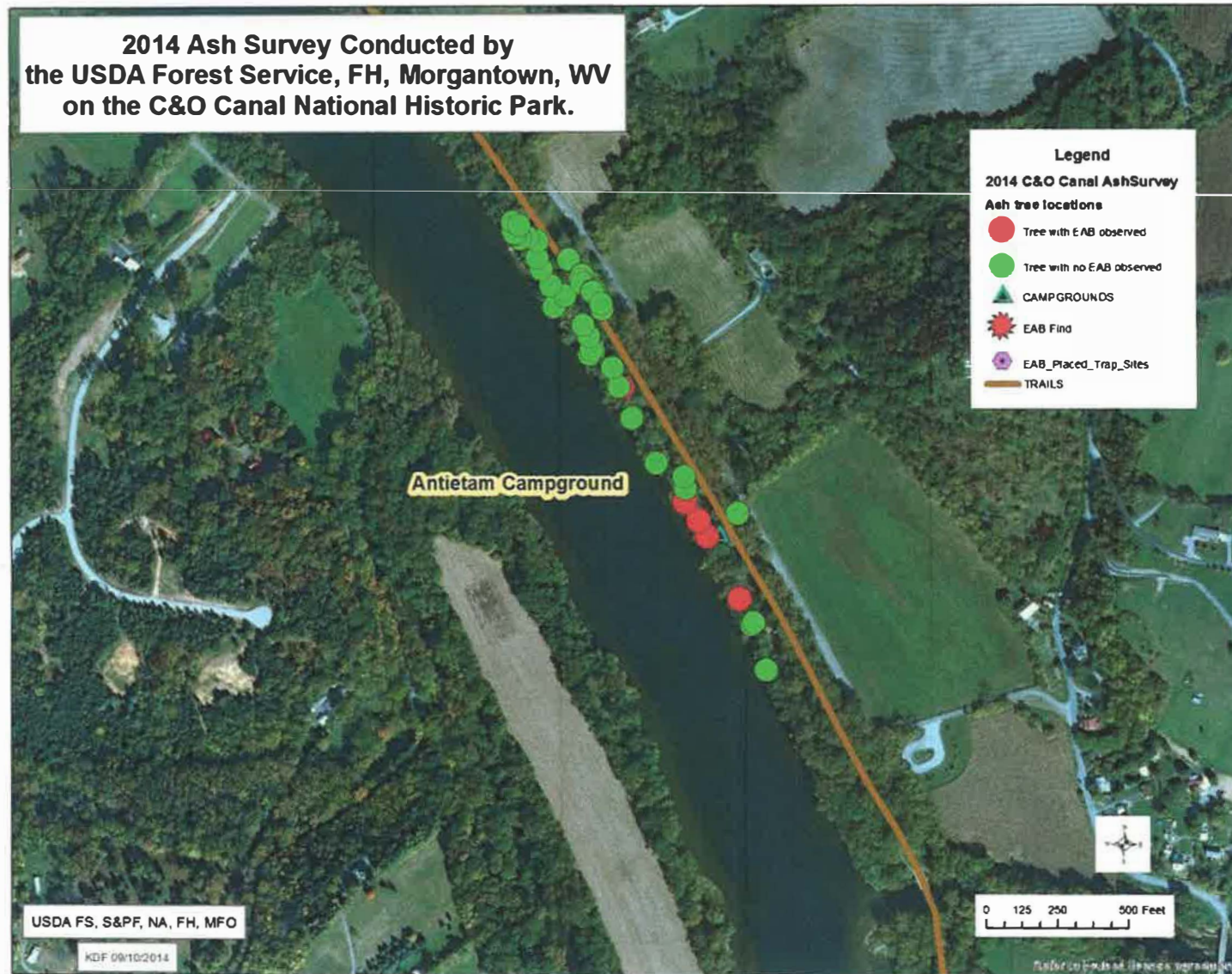
**Figure 3.** 15 Mile Creek Campground.



**Figure 4.** Paw Paw Campground.



**Figure 5.** McCoy's Ferry Campground.



## **Project Objectives**

The objectives for this evaluation were to 1) determine whether or not EAB was present and active within the campgrounds, 2) assess the location and extent of ash within the campgrounds, and 3) determine the need for ash treatments to protect and maintain the ash resources within the campgrounds.

## **Project Methods**

### *Ash Survey*

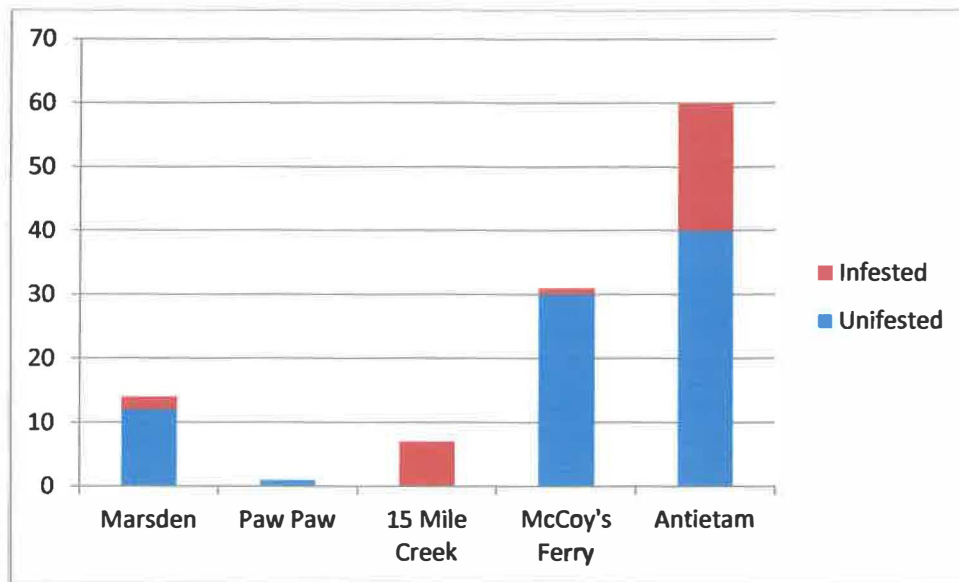
In the summer of 2014, USDA FS NA staff conducted an intensive ash inventory of the five campgrounds and one overlook. All ash trees within 100 feet of the campgrounds and  $\geq 1$  inch in diameter at breast height (d.b.h., measured at 4.5 ft. above the ground) were identified; tagged; visually inspected for signs and symptoms of EAB (e.g. woodpecker activity, D-shaped exit holes, serpentine galleries); and had their geocoordinates recorded using a hand-held GPS unit. The staff also looked for Pumpkin Ash on and near Bear Island.

## **Results**

### *Ash Tree Survey*

The emerald ash borer was found to be present and causing tree mortality in three campgrounds (15 Mile Creek, McCoy's Ferry, Antietam Creek) and the Angler's Inn overlook. Field surveys identified 114 ash trees within the campgrounds and overlook. Of the 111 ash trees inventoried, 105 were alive and 6 were dead. There were ash stumps present at 15 Mile Creek, which was the result of ash mortality from EAB attacks. The average d.b.h. for live ash trees was 10.5 inches; live trees ranged in size from 0.8 to 38.9 inches d.b.h. Woodpecker activity was noted on 20.7 percent of the tallied ash trees, and D-shaped exit holes were found on 11.7 percent of the ash trees. In total, it is predicted that at least 27.9 percent of the ash surveyed in 2014 at the Campgrounds and overlook are infested with EAB. Percent infested at the campgrounds varied: Marsden Tract 13.3, Angler's Inn Overlook 100, 15 Mile Creek 100, Paw Paw 0, McCoy's Ferry 3.3, and Antietam Creek 33.3 respectively. This is likely a significant underestimate because EAB is difficult to detect during the early stages of attack on a tree.

During the one day survey of Bear Island for Pumpkin Ash, none were located by the NA FH staff.



**Figure 7.** Uninfested Ash Trees vs. EAB Infested Ash Trees

**Table 1.** \*Treatable Trees

Campground	Treatable	Total dbh (inches)
Marsden	8	129
Paw Paw	0	0
15 Mile Creek	0	0
McCoy's Ferry	28	172
Antietam	26	189
Total	62	490

\*Treatable – any ash tree less 30% dieback, uninfested, no woodpecker damage, no decay and no bark splits.

## **Discussion**

The main objectives of this evaluation were to determine whether EAB was present, inventory the area, and evaluate the need for EAB management activities to protect the ash and prevent hazard trees. As we discussed in our previous conversation in late summer 2014, EAB is currently present and active at the project. We recommend that the C&O Canal NHP staff develop a comprehensive vegetation management plan that includes preemptive ash removal (e.g. removal of ash with poor form or defects, or removal of ash to lessen EAB population buildup); chemical treatments; removal of infested ash trees (e.g. hazard trees and trees beyond the chemical treatment stage); biological control releases; and replanting to ensure that a sustainable forest will continue at these campgrounds.

## **Management Alternatives**

For 2015, three options have been evaluated for managing EAB at these five C&O Canal NHP campgrounds. The intervention options are offered based on the following objectives: 1) protect high-value ash trees and 2) protect native woodland ash trees. Each option is discussed below.

### **Alternatives**

- |                |  |
|----------------|--|
| Alternative 1. | No action at all five campgrounds.   |
| Alternative 2. | Treat all campground ash trees with < 30 percent decline, remove ash trees with > 30 percent decline and release biological control agents at 3 three sites: Marsden Tract (treat 13 trees and remove one), McCoy's Ferry (treat 28 trees), and Antietam Creek (treat 26 trees and remove 19), Marsden (treat 8). Paw Paw only had one ash tree and 15 Mile Creek was 100 percent infested with all trees greater than 70 percent decline. |
| Alternative 3. | Limit treatments to campground trees >15 inches d.b.h. and release biological control agents at Marsden Tract, McCoy's Ferry and Antietam Creek.   |

### ***No Action Option***

In this option emerald ash borer is allowed to infest susceptible ash trees within the project. Should this option be selected, it is likely that all susceptible ash trees would be attacked and die as a result of EAB. This would result in the loss of not only high value trees but native woodland trees which would result in hazard trees in public areas, and a reduction in overstory canopy and soft mast production in these areas.

## **Intervention Options**

### ***Chemical Insecticide Option***

The second and third options involve using chemical insecticides to prevent and control EAB. Herms and others (2014) reviewed chemical control options for EAB, which include noninvasive

systemic basal trunk sprays, soil-applied systemic insecticides, trunk-injected systemic insecticides, and protective cover sprays.

- Dinotefuran (Safari®) is labeled for controlling EAB and has shown variable results. It is sprayed on the lower 5 or 6 feet of trunk.
- Soil injection of imidacloprid has shown variable results and requires careful attention to soil conditions and tree d.b.h. Soil injections should be applied 2-4 inches below the soil surface to stay available to feeder roots, the soil should be moist to facilitate uptake, and chemical amounts should be increased or combined with other treatment methods for trees larger than 15 inches d.b.h.
- Trunk injection of emamectin benzoate in mid-May or early June provides the most consistent control of EAB, according to test trials at Michigan State and Ohio State Universities. This was the only treatment that provided multiple years of protection (up to 3 years).
- Protective cover sprays have been shown to prevent EAB from entering trees in Michigan State University studies, but have no effect on larvae feeding under the bark. Spraying the entire tree is most effective, but there is considerable drift associated with this process.
- A natural product, azadirachtin, is also available formulated as TreeAzin™, which has the potential for systemic control of EAB. This product is a natural tetranortriterpenoid compound extracted from the seed kernels of neem (*Azadirachta indica*) (Fares and others 1980) and is injected into the trunk of the tree.

### *Biological Control*

Currently, three parasitoid wasps, including two gregarious larval endoparasitoid species (*Spathius agrili* and *Tetrastichus planipennisi*) and a solitary parthenogenic egg parasitoid (*Oobius agrili*) are available for release against EAB. The release and establishment of EAB natural enemies is not likely to provide any short-term control of EAB. This long-term approach is still experimental and will likely require a complex of natural enemies to maintain EAB below damaging levels. It may be years before these parasites can perpetuate themselves sufficiently before any level of success can be determined.

## Recommendations

Because EAB is already active at the C&O Canal NHP, we recommend that the C&O Canal NHP staff develop a comprehensive ash/forest management plan and put a chemical suppression/prevention treatment plan into place as soon as possible. In addition, we recommend that the C&O Canal NHP staff begin a public awareness campaign about EAB.

We recommend Alternative 2 based on the following considerations:

- 1) The high number of ash trees infested by EAB at the park.
- 2) This alternative protects high-value ash trees and retains both large and smaller specimen trees.
- 3) We also recommend releasing available EAB parasitoids in infested areas that are not in proximity to chemical treatments. The establishment of these natural enemies is experimental, but may offer the opportunity for long-term control and may minimize the need for repeated chemical treatments in future years.

## Species Evaluation

Emerald ash borer (EAB), *Agrilus planipennis* (Fairmaire), is a wood-boring beetle from Eastern Asia (Poland and McCullough 2006) that is causing severe mortality in North American ash (Tluczek and others 2011). EAB affects all species and diameter classes of ash and often kills both healthy and stressed trees within 3 to 5 years of their becoming infested (Siegert and others 2006).

Based on data from the USDA Animal and Plant Health Inspection Service, EAB emerges around mid-June and is present through mid-August ([www.emeraldashborer.info](http://www.emeraldashborer.info)). Adult beetles are slender, elongate, and bright green, and feed on ash foliage in patches along the leaf margins (Kovacs and others 2010). Adult beetles usually live for about 3 weeks, and females lay about 60-90 eggs (McCullough and Katovich 2004). Eggs hatch in 7-10 days, and larvae chew through the bark and feed on phloem and outer sapwood for several weeks, creating S-shaped galleries packed with frass (Bauer and others 2004). Larvae are white to cream colored, have 10 segments, and are flattened. Larvae overwinter in shallow chambers in the outer sapwood or bark on thick-barked trees (Bauer and others 2004). EAB pupate in late April or May, and adults emerge 1-2 weeks after pupation through D-shaped exit holes (McCullough and Katovich 2004).

In addition to causing severe economic damage, there are ecological consequences associated with the loss of ash from North American forests. Studies show that ash trees provide food and habitat for several bird and mammal species (Faanes 1984, Rumble and Gobeille 1998). Forty-three native arthropod species are at high risk due to their association with ash for breeding or feeding (Gandhi and others 2010). Ash also contributes to nutrient cycling in hardwood forests (Reiners and Reiners 1970).

## References

- Bauer, L.S.; Haack, R.A.; Miller, D.L.; Petrice, T.R.; Liu, H. 2004. Emerald ash borer life cycle. In: Mastro, Victor; Reardon, Richard, comps. Emerald ash borer research and technology development meeting. FHTET-2004-02. Morgantown, WV: U.S. Forest Service, Forest Health Technology Enterprise Team: 8.
- Faanes, C.A. 1984. Wooded islands in a sea of prairie – these isolated woodlands are important breeding habitat for northern prairie birds. *American Birds*. 38(1): 3–6.
- Gandhi, K.J.K.; Cognato, A.I.; Lightle, D.M.; Mosley, B.J.; Nielsen, D.G.; Herms, D.A. 2010. Species composition, seasonal activity, and semiochemical response of native and exotic bark and Ambrosia beetles (Coleoptera: Curculionidae: Scolytinae) in northeastern Ohio. *Journal of Economic Entomology*. 103(4): 1187–1195.
- Herms, D.A.; McCullough, D.G.; Smitley, D.R.; Sadof, C.S.; Cranshaw, W. 2014. Insecticide options for protecting ash trees from emerald ash borer. North Central IPM Center Bulletin. 2<sup>nd</sup> Edition. 16 p.
- Kovacs, K.F.; Haight, R.G.; McCullough, D.G.; Mercader, R.J.; Siegert, N.W.; Liebhold, A.M. 2010. Cost of potential emerald ash borer damage in U.S. communities, 2009–2019. *Ecological Economics*. 69(3): 569–578.
- McCullough, D.G.; Katovich, S.A. 2004. Pest Alert: emerald ash borer. NA-PR-02-04. U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry. 2 p.
- Poland, T.M.; McCullough, D.G. 2006. Emerald ash borer: invasion of the urban forest and the threat to North America's ash resource. *Journal of Forestry*. 104(3): 118–124.
- Reiners, W.A.; Reiners, N.M. 1970. Energy and nutrient dynamics of forest floors in three Minnesota forests. *Journal of Ecology*. 58(2): 497–519.
- Rumble, M.A.; Gobeille, J.E. 1998. Bird community relationships to succession in green ash (*Fraxinus pennsylvanica*) woodlands. *American Midland Naturalist*. 140: 372–381.
- Siegert, N.W.; McCullough, D.G.; Liebhold, A.M.; Telewski, F.W. 2006. Spread and dispersal of emerald ash borer: a dendrochronological approach. In: Mastro, V.; Reardon, R.; Parra, G., comps. Emerald ash borer research and technology development meeting. FHTET-2005-16. Morgantown, WV: U.S. Department of Agriculture, Forest Service, Forest Health Technology Enterprise Team: 10.
- National Parks Conservation Association. State of the Parks: Chesapeake and Ohio Canal National Historical Park. A resource Assessment. April 2004
- Thuczek, A.R.; McCullough, D.G.; Poland, T.M. 2011. Influence of host stress on emerald ash borer (Coleoptera: Buprestidae) adult density, development, and distribution in *Fraxinus pennsylvanica* trees. *Environmental Entomology*. 40(2): 357–366.